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DOCKET NO.: S1022.80526US00

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Luc WUIDART  
 Serial No.: 09/770,783 Patent No.: 6,960,985 B2  
 Filed: January 26, 2001 Issued: November 1, 2005  
 For: ADAPTATION OF THE TRANSMISSION POWER OF AN  
 ELECTROMAGNETIC TRANSPONDER READER  
 Examiner: Brian A. Zimmerman  
 Art Unit: 2635 Confirmation No.: 8267

**Certificate**

JAN 27 2006

**of Correction**

ATTN: Certificate of Correction Branch  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, VA 22313-1450

**REQUEST FOR CERTIFICATE  
 OF CORRECTION UNDER 37 C.F.R. §1.323**

Sir/Madam:

Patentees respectfully request the correction of errors found in the above-captioned patent. Specifically, there are typographical errors in formulas 20 and 21 and in claim 21 of issued U.S. Patent No. 6,960,985 B2.

Formulas 20 and 21 are reproduced below as they appear in column 17, lines 30-43:

$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1}{I}}{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1_{\max}}{I_{\max}}} \quad (\text{formula 20})$$

Now, by applying formula 3 to the above formula, one obtains:

$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{k^2}{k_{\max}^2} \quad (\text{formula 21})$$

Formulas 20 and 21 are reproduced below as they appear on page 23, lines 16-18 of the application as filed:

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$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1}{I}}{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1_{\max}}{I_{\max}}} \quad (\text{formula 20})$$

Now, by applying formula 3 to the above formula, one obtains:

$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{k^2}{k_{\max}^2} \quad (\text{formula 21})$$

No amendment was made by the Examiner or Patentee to change “ $a_{\max}^2$ ” to “ $a_{\max}^2$ ” in equations 20 and 21 and no amendment was made by the Examiner or Patentee to change “ $k_{\max}^2$ ” to “ $k_{\max}^2$ ” in formula 21.

Claim 21, as it appears in column 20, lines 54-58, of U.S. Patent No. 6,960,985 is reproduced below.

21. The terminal of claim 15, **where** the phase regulating circuit is operative to detect a phase interval between a current in the oscillating circuit and the reference signal and to modify a capacitance of the oscillating circuit in response to the phase interval. (Emphasis added)

Claim 23, as it appeared in the Amendment After Final filed on October 12, 2004 is reproduced below (claim 23 of the amendment corresponds to claim 21 of the issued patent).

23. The terminal of claim 15, **wherein** the phase regulating circuit is operative to detect a phase interval between a current in the oscillating circuit and the reference signal and to modify a capacitance of the oscillating circuit in response to the phase interval. (Emphasis added)

No amendment was made by the Examiner or Patentee to change “wherein” to “where” in the first line of this claim.

No amendment was made by the Examiner or Patentee to change “at least one” to “at least on” in line 15 of this claim. Patentee desires to have the formulas corrected and claim 21

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amended to read --where-- as filed in the October 12, 2004 amendment and respectfully request that a Certificate of Correction be granted in U.S. Letters Patent No. 6,960,985 to make the corrections as specified herein and on the attached Certificate of Correction, PTO form SB/44.

In support of the above, Patentee encloses a highlighted copy of page 23 of the application as filed, page 5 of the Amendment After Allowance filed on October 12, 2004 and columns 17 and 20 of issued U.S. Patent No. 6,960,985. Also enclosed is a Certificate of Correction form PTO Form SB/44.

The corrections requested do not involve change in the patent that constitutes new matter or would require reexamination. Therefore, it is respectfully requested that the correction be made and that a Certificate of Correction be issued.

Since neither of the above amendments were made by either Patentee or the Examiner it is respectfully requested that the corrections as specified herein and on the attached Certificate of Correction, PTO form SB/44 be made and a Certificate of Correction be granted. Patentee respectfully submits that, since the errors for which a Certificate of Correction is sought was the result of Patent Office mistake, no fee is due. However, if the Examiner deems a fee necessary, the fee may be charged to the account of the undersigned, Deposit Account No. 23/2825.

Should any questions arise concerning the foregoing, please contact the undersigned at the telephone number listed below.

**CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)**

I hereby certify that this document is being placed in the United States mail with first-class postage attached, addressed to Correspondence and Mail Division, Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the ~~19th~~ day of January, 2006.



Attorney Docket No.: S1022.80526US00  
**XNDD**

Respectfully submitted,

*Luc Wuidart, Applicant*

By: 

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JAN 30 2006

with:

$$X1 = \omega \cdot L1 - \frac{1}{\omega \cdot C1} \quad (\text{formula 16})$$

Now, due to the phase regulation, imaginary part  $X1_{app}$  is null. Accordingly:

$$X1 = a2 \cdot X2. \quad (\text{formula 17})$$

5 The difference between the instantaneous and off-load values can be expressed in the following way:

$$X1 - X1_{off-load} = a^2 \cdot X2 - a_{off-load}^2 \cdot X2. \quad (\text{formula 18})$$

Now, the coefficient  $a_{off-load}$  corresponding to the value at point p6 is null (coupling koff-load is null). Further, voltage VC1 across element 24 (neglecting the influence of  
10 intensity transformer 23) can be written as  $I/\omega C1$ , I being, for example, measured by transformer 23. As a result, formula 18 hereabove can be written as:

$$a2 \cdot X2 = \frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I} \quad (\text{formula 19})$$

By expressing the ratio of the expressions of formula 18 applied to the instantaneous value and to the maximum coupling, and by replacing them in formula 19 hereabove, one  
15 may write:

$$\frac{a^2 \cdot X2}{a_{max}^2 \cdot X2} = \frac{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I}}{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1_{max}}{I_{max}}} \quad (\text{formula 20})$$

Now, by applying formula 3 to the above formula, one obtains:

$$\frac{a^2 \cdot X2}{a_{max}^2 \cdot X2} = \frac{k^2}{k_{max}^2} \quad (\text{formula 21})$$

Thus, ratio  $k/k_{max}$  between the instantaneous and maximum coupling coefficients can  
20 be expressed, when a transponder is present in the terminal's field, as:

$$\frac{k}{k_{max}} = \sqrt{\frac{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I}}{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1_{max}}{I_{max}}}} \quad (\text{formula 22})$$

Now, the values of current I and of voltage VC1 off-load and at maximum coupling have been measured during the learning phase. Accordingly, it is enough to measure the



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Examiner: Brian A. Zimmerman  
Art Unit: 2635 Confirmation No.: 8267

ATTN: Certificate of Correction Branch  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir/Madam:

Transmitted herewith for filing is/are the following document(s):

- ☒ Request for Certificate of Correction
- ☒ Copies of: Page 23 of Apl as Filed, Page 5 of Amn Filed 10/12/04 and Cols. 17 and 20 of issued U.S. Patent No. 6,960,985.
- ☒ PTO Form SB/44
- ☒ Return Post Card

If the enclosed papers are considered incomplete, the Mail Room and/or the Application Branch is respectfully requested to contact the undersigned collect at (617) 646.8000, Boston, Massachusetts.

No check is enclosed. If it is determined that a fee is necessary, the fee may be charged to the account of the undersigned, Deposit Account No. 23/2825. A duplicate of this sheet is enclosed.

**CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)**

I hereby certify that this document is being placed in the United States mail with first-class postage attached, addressed to Correspondence and Mail Division, Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the 19<sup>th</sup> day of January, 2006.

Attorney Docket No.: S1022.80526US00  
**XNDD**

Respectfully submitted,

*Luc Wuidart, Applicant*

By:

James H. Morris, Reg. No.: 34,681  
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600 Atlantic Avenue  
Boston, Massachusetts 02210  
Tel. (617) 646.8000

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17. (Previously Presented) The terminal of claim 15, further comprising:  
an oscillator to provide an excitation signal to the oscillating circuit,  
wherein the reference signal corresponds to the excitation signal.
18. (Previously Presented) The terminal of claim 15, further comprising:  
a control unit to control a substantially linear modification of a power transmitted by the  
terminal based on a distance between the transponder and the terminal.
19. (Previously Presented) The terminal of claim 18, wherein the control unit is  
operative to control modification of the power transmitted by the terminal by controlling  
modification of a value of a resistive element in the terminal.
20. (Previously Presented) The terminal of claim 18, wherein the control unit is  
operative to control modification of the power transmitted by the terminal by controlling  
modification of a value of a voltage generated by the terminal.
21. (Previously Presented) The terminal of claim 18, wherein the control unit is  
operative to evaluate a distance between the transponder and the terminal according to phase  
correction information provided by the phase regulating circuit.
22. (Previously Presented) The terminal of claim 21, wherein the phase correction  
information includes a voltage across a capacitive element of the oscillating circuit.
23. (Previously Presented) The terminal of claim 15, wherein the phase regulating  
circuit is operative to detect a phase interval between a current in the oscillating circuit and the  
reference signal and to modify a capacitance of the oscillating circuit in response to the phase  
interval.

with:

$$X1 = \omega \cdot L1 - \frac{1}{\omega \cdot C1} \quad (\text{formula 16})$$

Now, due to the phase regulation, imaginary part  $X1_{app}$  is null. Accordingly:

$$X1 = a2 \cdot X2 \quad (\text{formula 17})$$

The difference between the instantaneous and off-load values can be expressed in the following way:

$$X1 - X1_{off-load} = a^2 \cdot X2 - a_{off-load}^2 \cdot X2 \quad (\text{formula 18})$$

Now, the coefficient  $a_{off-load}$  corresponding to the value at point p6 is null (coupling off-load is null). Further, voltage VC1 across element 24 (neglecting the influence of intensity transformer 23) can be written as  $I/\omega C1$ , I being, for example, measured by transformer 23. As a result, formula 18 hereabove can be written as:

$$a^2 \cdot X2 = \frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I} \quad (\text{formula 19})$$

By expressing the ratio of the expressions of formula 18 applied to the instantaneous value and to the maximum coupling, and by replacing them in formula 19 hereabove, one may write:

$$\frac{a^2 \cdot X2}{a_{max}^2 \cdot X2} = \frac{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I}}{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1_{max}}{I_{max}}} \quad (\text{formula 20})$$

Now, by applying formula 3 to the above formula, one obtains:

$$\frac{a^2 \cdot X2}{a_{max}^2 \cdot X2} = \frac{k^2}{k_{max}^2} \quad (\text{formula 21})$$

Thus, ratio  $k/k_{max}$  between the instantaneous and maximum coupling coefficients can be expressed, when a transponder is present in the terminal's field, as:

$$\frac{k}{k_{max}} = \sqrt{\frac{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1}{I}}{\frac{VC1_{off-load}}{I_{off-load}} - \frac{VC1_{max}}{I_{max}}}} \quad (\text{formula 22})$$

Now, the values of current I and of voltage VC1 off-load and at maximum coupling have been measured during the learning phase. Accordingly, it is enough to measure the current I and VC1 to determine ratio  $k/k_{max}$  and apply one of the functions  $Vg=f(k/k_{max})$  described hereabove, according to whether the system has been determined upon learning as having a monotonous response or not.

The implementation of the present invention uses the digital terminal control circuits in that it is necessary to store measurements and perform calculations on these measurements. These circuits, which have not been detailed in FIG. 2, are comprised in block 4 of FIG. 1. Dedicated calculators formed in wired logic or, to benefit from adaptation

capacities, software means programming a microprocessor of block 4 may be used.

It should be noted that other means may be used to bias a variable capacitive element 24. What matters is to have an information proportional to the phase regulation control.

By applying the previously-discussed learning and determination method, current I in the oscillating circuit is measured (by means of transformer 23) both off-load and by laying a transponder on the terminal to be at maximum coupling. Values  $I_{off-load}$  and  $I_{max}$  are obtained and stored at the same time as the corresponding values  $VC1_{off-load}$  and  $VC1_{max}$ . It should thus be noted that, although reference has been made, for clarity, to the value of coupling coefficient k, it may actually be the quantities on which it depends. These quantities can then be processed directly by replacing coupling k by its expression as a function of these quantities in the above-discussed formulas.

An advantage of the present invention is that it enables adapting the transmission power of the reader to the transponder position. The power consumption of the reader can then be optimized by being reduced when a transponder is located close to the optimal coupling. The system range is also optimized by enabling a high power transmission when a transponder is far away from the terminal without risking damaging it since this power is decreased as the transponder comes close to the terminal.

Another advantage of the present invention is that it overcomes the problems due to the non-monotonous response of a transponder according to the coupling.

Another advantage of the present invention is that a read terminal that can be adapted to different transponder families can be provided, be it upon manufacturing, upon installation, or in an on-the-spot operation. It is enough, for this purpose, to use the computer means generally present in the terminal and to provide a program for configuring this terminal to a given transponder family.

Another advantage of the present invention is that it is independent from the transponder. Indeed, no structural modification of a transponder is necessary to implement the present invention. Accordingly, a read terminal of the present invention can be used with conventional transponders.

Of course, the present invention is likely to have various alterations, modifications, and improvements which will readily occur to those skilled in the art. In particular, the practical implementation of the selection circuit (25, FIG. 2) and of the means of automatic determination of the quantities necessary to implement the present invention are within the abilities of those skilled in the art according to the application and to the functional indications given hereabove. Further, it should be noted that other types of variable capacitive elements may be used, provided that the use of the information provided by the phase regulation loop to set this variable capacitive element is respected.

Among the applications of the present invention, readers (for example, access control terminals or porticoes, automatic dispensers, computer terminals, telephone terminals, televisions or satellite decoders, etc.) of contactless chip cards (for example, identification cards for access control, electronic purse cards, cards for storing information about the card holder, consumer fidelity cards, toll television cards, etc.) will more particularly be pointed out.

Such alterations, modifications, and improvements are intended to be part of this disclosure, and are intended to be within the spirit and the scope of the present invention. Accordingly, the foregoing description is by way of example only and is not intended to be limiting. The present invention

is limited only as defined in the following claims and the equivalents thereto.

What is claimed is:

1. A terminal for generating an electromagnetic field adapted to cooperating with at least one transponder when the at least one transponder is within said electromagnetic field and including an oscillating circuit adapted to receiving a high frequency A.C. excitation voltage, including:

means for maintaining a constant phase relationship between a signal in the oscillating circuit and a reference signal;

means for determining an instantaneous information relative to an instantaneous magnetic coupling between the transponder and the terminal; and

means for adapting a power of the electromagnetic field according to at least said instantaneous information.

2. The terminal of claim 1, including means for measuring a first quantity which is a function of an instantaneous voltage across a capacitive element of said oscillating circuit and a second quantity which is a function of an instantaneous current in said oscillating circuit.

3. The terminal of claim 2, including means for determining and storing characteristic information relative to a magnetic coupling between the transponder and the terminal in several determined configurations of a distance separating the transponder from the terminal, and for taking account said characteristic information in the adaptation of the electromagnetic field power.

4. The terminal of claim 3, wherein said characteristic information includes, among others:

a voltage across the capacitive element when no transponder is present in the electromagnetic field of the terminal;

a voltage across the capacitive element when a transponder is in a relation of maximum closeness with the terminal;

a current in the oscillating circuit when no transponder is present in the field of the terminal; and

a current in the oscillating circuit when a transponder is in a relation of maximum closeness with the terminal.

5. The terminal of claim 3, wherein said instantaneous information is deduced from respective values of said two quantities and of respective values of said characteristic information.

6. The terminal of claim 3, wherein at least one characteristic information is automatically determined by the terminal in a learning phase.

7. The terminal of claim 1, wherein the means for adapting the power of the electromagnetic field includes means controllable to modify the A.C. excitation voltage of the oscillating circuit of the terminal.

8. The terminal of claim 1, wherein the means for adapting the power of the electromagnetic field include one or more controllable resistive elements, belonging to the oscillating circuit of the terminal.

9. The terminal of claim 1, wherein a response time of the means for maintaining is chosen to be large as compared to a frequency of a possible back-modulation coming from a transponder present in the electromagnetic field of the terminal and to be fast as compared to a displacement speed of a transponder in this electromagnetic field.

10. The terminal of claim 1, wherein said oscillating circuit includes an element of variable capacitance, said terminal including means adapted to determining a value of this capacitance based on a phase measurement on the signal in the oscillating circuit by varying a voltage across the element of variable capacitance.

11. The method of claim 1, wherein the terminal further includes:

an oscillator to provide an excitation signal to the oscillating circuit, and

wherein the reference signal corresponds to the excitation signal.

12. The method of claim 1, wherein the means for maintaining a constant phase relationship is operative to maintain a constant relationship between a phase of a current in the oscillating circuit and a phase of the reference signal.

13. A terminal for generating an electromagnetic field, the terminal being adapted to cooperate with a transponder when the transponder is within the electromagnetic field, the terminal comprising:

an oscillating circuit; and

a phase regulating circuit to maintain a constant phase relationship between a current in the oscillating circuit and a reference signal.

14. The system of claim 13, wherein the transponder imposes a load on the oscillating circuit when the transponder is within the electromagnetic field, the imposed load impacting an impedance of the oscillating circuit and

wherein the phase regulation circuit is operative to compensate for an imaginary part of the imposed load so that an imaginary part of the impedance of the oscillating circuit is null.

15. The terminal of claim 13, further comprising:

an oscillator to provide an excitation signal to the oscillating circuit,

wherein the reference signal corresponds to the excitation signal.

16. The terminal of claim 13, further comprising:

a control unit to control a substantially linear modification of a power transmitted by the terminal based on a distance between the transponder and the terminal.

17. The terminal of claim 16, wherein the control unit is operative to control modification of the power transmitted by the terminal by controlling modification of a value of a resistive element in the terminal.

18. The terminal of claim 16, wherein the control unit is operative to control modification of the power transmitted by the terminal by controlling modification of a value of a voltage generated by the terminal.

19. The terminal of claim 16, wherein the control unit is operative to evaluate a distance between the transponder and the terminal according to phase correction information provided by the phase regulating circuit.

20. The terminal of claim 19, wherein the phase correction information includes a voltage across a capacitive element of the oscillating circuit.

21. The terminal of claim 13, where the phase regulating circuit is operative to detect a phase interval between a current in the oscillating circuit and the reference signal and to modify a capacitance of the oscillating circuit in response to the phase interval.

22. The terminal of claim 13, further comprising:

a current measurement circuit to measure a value of the current in the oscillating circuit and to provide the measured value to the phase regulating circuit.

23. The terminal of claim 13, further comprising:

a storage element to store measurement values corresponding to at least two conditions, the measurement values being acquired during a learning phase of operation of the terminal.

## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

PATENT NO. : 6,960,985  
DATED : November 1, 2005  
INVENTOR(S) : Luc Wuidart

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 17, formulas 20 and 21 should read as shown below:

$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1}{I}}{\frac{VC1_{\text{off-load}}}{I_{\text{off-load}}} - \frac{VC1_{\max}}{I_{\max}}} \quad (\text{formula 20})$$

$$\frac{a^2 \cdot X2}{a_{\max}^2 \cdot X2} = \frac{k^2}{k_{\max}^2} \quad (\text{formula 21})$$

Claim 21, col. 20, line 53 should read as shown below:

--21. The terminal of claim 13, wherein the phase regulating--

MAILING ADDRESS OF SENDER

PATENT NO. 6,960,985

James H. Morris  
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JAN 30 2006